

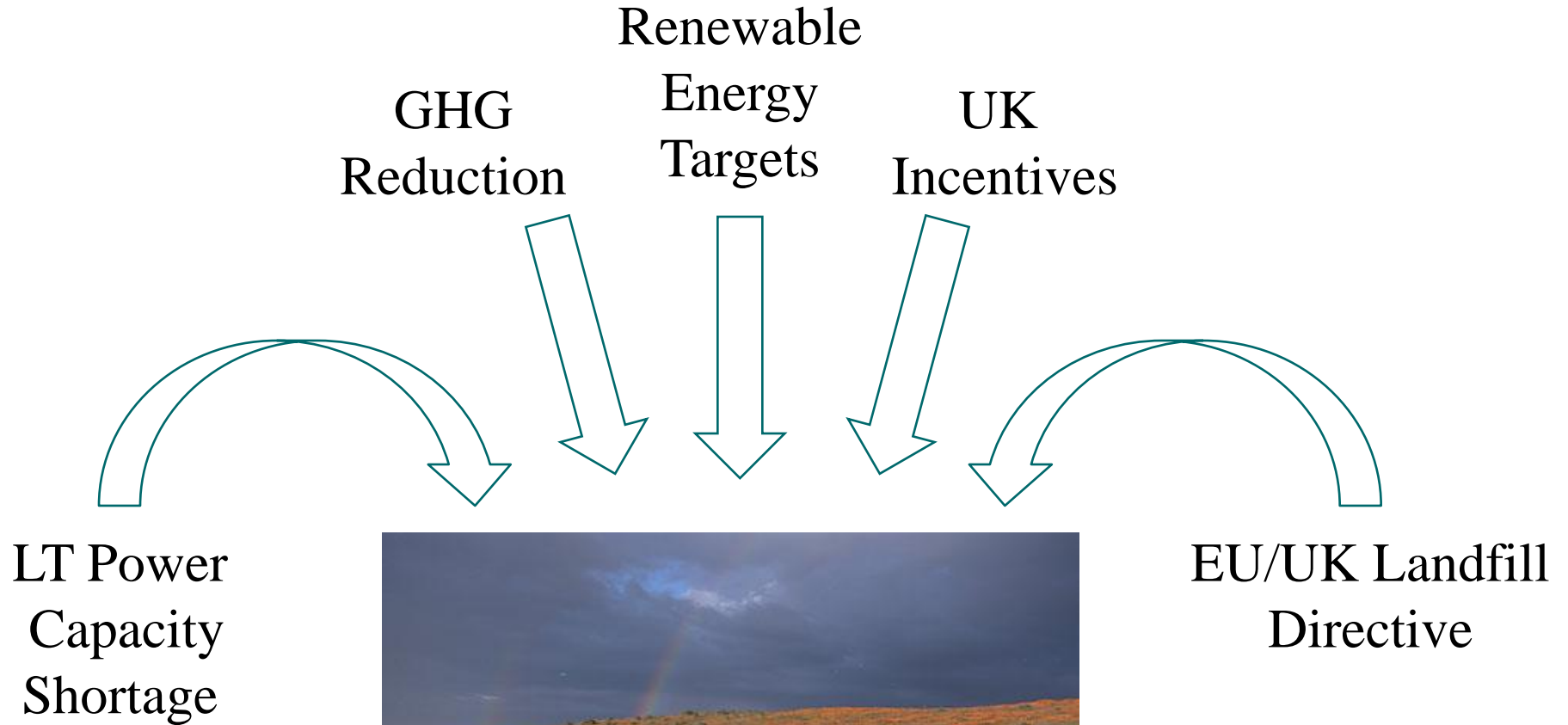


# Air Products Proposed Renewable Energy Facility in Tees Valley

28<sup>th</sup> February 2011



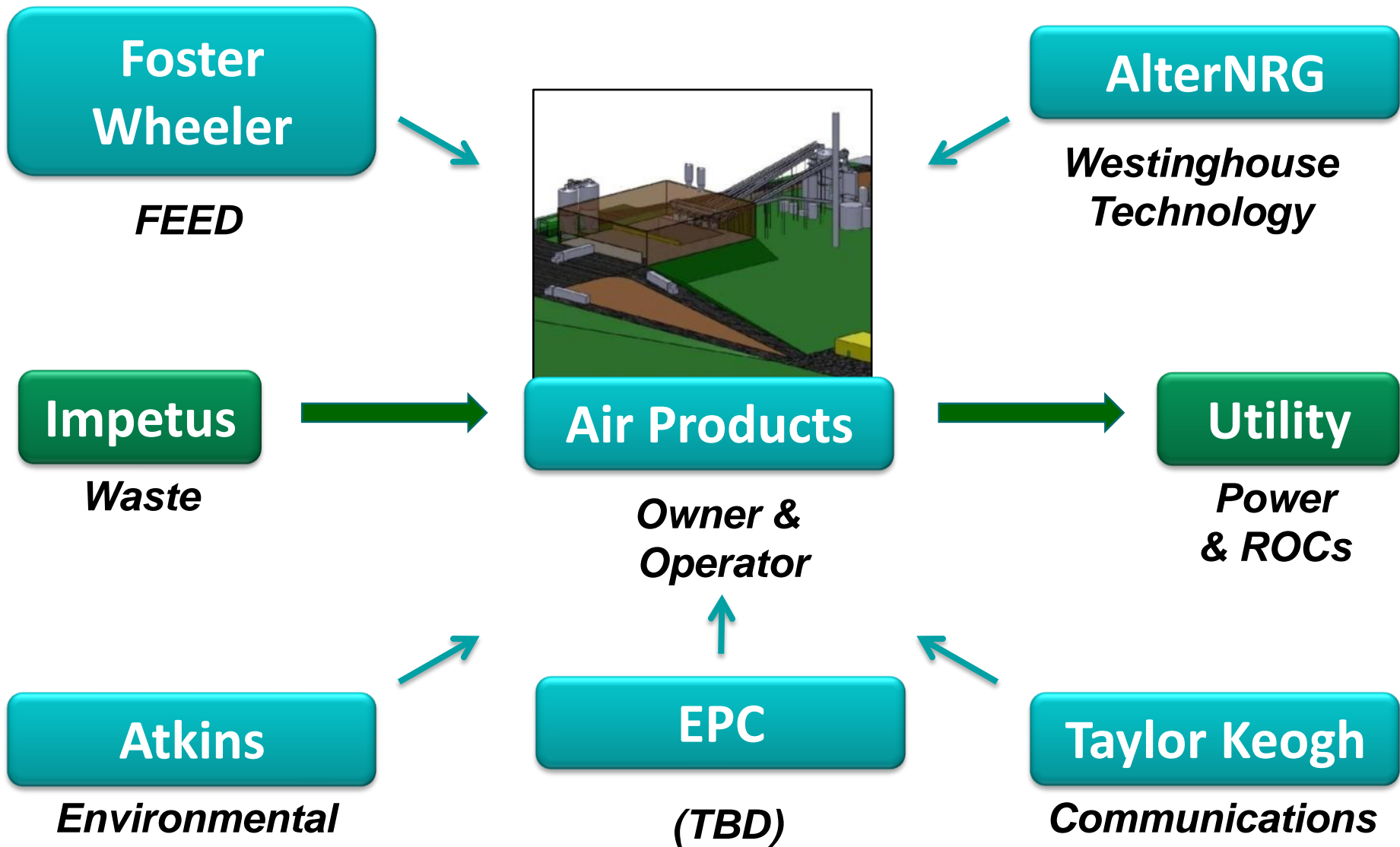
# UK Waste Gasification – The Perfect Storm



# Proposed Project

- 300,000-350,000 tonnes waste processed per annum
- Waste supply and power agreements under development
- Planning for household, commercial, and industrial waste
- 49MW of baseload, renewable power
- One North East supporting feasibility study

# Tees Valley Renewable Energy Facility Team



# Project Timeline

- Meetings with Stockton council (SBC) June 2009
- Project development –on going
  - Environmental Engineer award May 2010
  - Pilot testing June/July 2010
  - Scoping report issued to SBC July 2010
  - Pre application public consultation Oct 2010
  - Engineering FEED Phase award October 2010
  - Development platform work Oct 10- end March 11
- Planning submission Feb 2011
- EPR submission End March 2011
- Construction start – Autumn 2011
- Commercial operation – 2013 / 2014

# Location: Reclamation Pond, Seal Sands

- Designated for B2 and B9 land use away from local housing & close to a major industrial complex with excellent road links
- Electrical distribution infrastructure access & connectivity
- Site close to existing landfill
- Adjacent to approved gas-fired power plant
- Part of the New Energy & Business Technology Park



Approximate location for the Air Products Facility

# Waste Management

## Impetus Waste Management (IWM)

- AP's waste partner and project landowner
- Managed c.900,000 tonnes waste per annum to fill and restore the Bran Sands & Cowpen landfill sites
- Operates & owns non-hazardous & hazardous landfills
- Impetus Reclamation formed and North Tees site acquired (2005):
  - 640 acres and tenants including Sabic, Petroplus and Growhow

## Waste and the proposed Air Products facility

- Pre-treated household, commercial & industrial waste currently destined for landfill in Teesside
- Sourced from the North East region
  - 300,000-350,000 tonnes waste to be processed per annum
  - 75-85% of Impetus landfill waste to be redirected, minimizing traffic movements
  - 15-25% to be redirected waste from other landfills in the region





# Why Plasma Gasification?

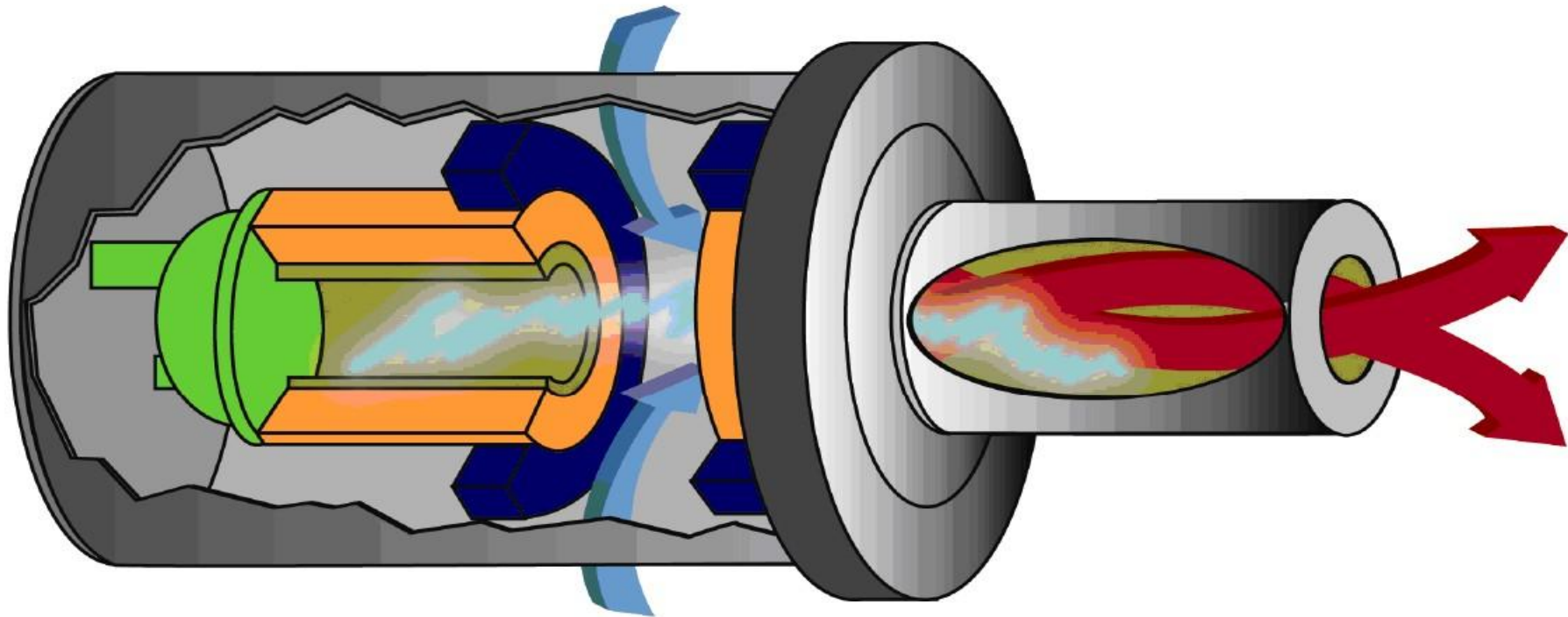
- Advantages of plasma
  - Increased temperatures with a higher degree of temperature control
  - Ability to gasify blended feedstock including waste
  - Through adjustment of O<sub>2</sub> addition and torch power, can control syngas H<sub>2</sub>/CO ratio
  - Increased control in the process
  - Reduced operating and capital costs
- End product
  - **Low-BTU** <8MJ/m<sup>3</sup> >syngas can be used as a fuel to generate electricity or steam, or used as a basic chemical building block in the petrochemical and refining industries
- Energy Efficiency
  - Plasma Torches use 2% to 5% of the energy input
- Westinghouse Experience
  - Westinghouse has issued 70 licenses over 30 years
  - Three plants in Japan burning MSW
  - One plant in India burning Hazardous Waste
  - Two 2<sup>nd</sup> Generation Alter Plants (India & Turkey) under construction burning Hazardous Waste
- ❖ Gasification is not incineration
- ❖ Gasification is not combustion

# Westinghouse Plasma / Alter NRG Gasification

- WPC plasma technology was developed over 40 years with over \$100MM in R&D funding by Westinghouse Electric Corp.
- 48 TPD Demonstration Facility in Madison, PA where over 100 different types of feedstocks have been tested
- Alter NRG owns the Westinghouse plasma technology and has successfully created demand for the technology globally
- Commercially proven facilities globally; Japan (3), India (1)
- Multiple projects in development globally
  - Projects and engineering in UK, European Union, Asia / India and North America; developing opportunities in Africa, Middle East and South America



# Westinghouse Industrial Plasma Torch



- |   |   |  |  |
|---|---|--|--|
|  Plasma Column |  Entering Process Gas |  Magnetic Field          |  Power Terminals |
|  Electrodes   |  Heated Process Gas  |  Cooling Water Manifold |  |

# Westinghouse Industrial Plasma Torches – Power on Demand for Thermostatic Control

- Self-stabilized arc system
- Non-transferred arc
- Flexible process heater - used for heating process gas to high temperatures, 1,500°C - 10,000°C
- Can operate on most gases - air, pure oxygen, nitrogen, carbon-monoxide, hydrogen, etc.
- Nominal power 300 kW – 3,000 kW
- Typical electrode life of up to 2,000 hours
- Industrially-rugged design
- Proven in tough commercial environment

## WPC Plasma Torches



### Sample of projects using WPC Plasma Torches

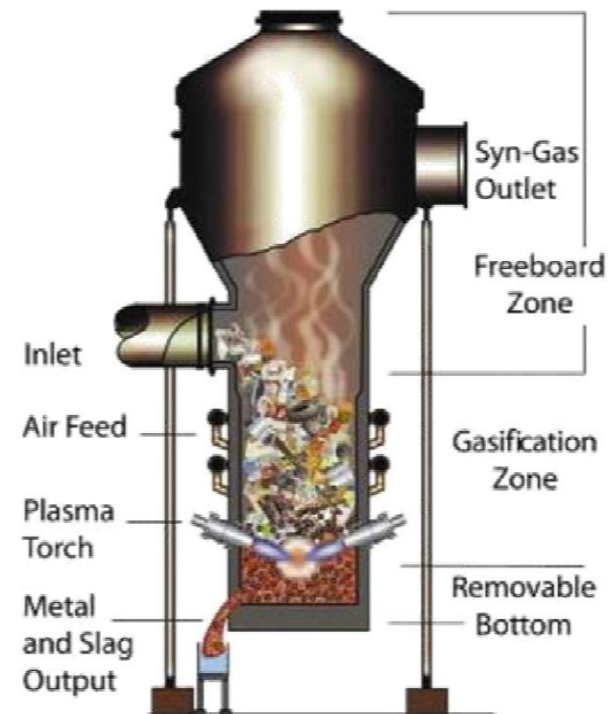
- WTE facilities in Japan
- GM Foundry in Defiance, Ohio
- Alcan Aluminum Facility in Quebec
- Two hazardous waste facilities in India (2008)

# Westinghouse Plasma / Alter NRG Gasifier

- The Proprietary Alter NRG Plasma Gasifier (APG) design is based on the Iron-Melting Cupola Furnace
  - Proven in harsh operating environments
  - Refractory lined steel vessel with lower section water cooled
  - Able to generate high operating temperature, reducing gas velocities
  - Ash produced as vitreous non-leaching slag
- Typical reactor capacities vary by feedstock

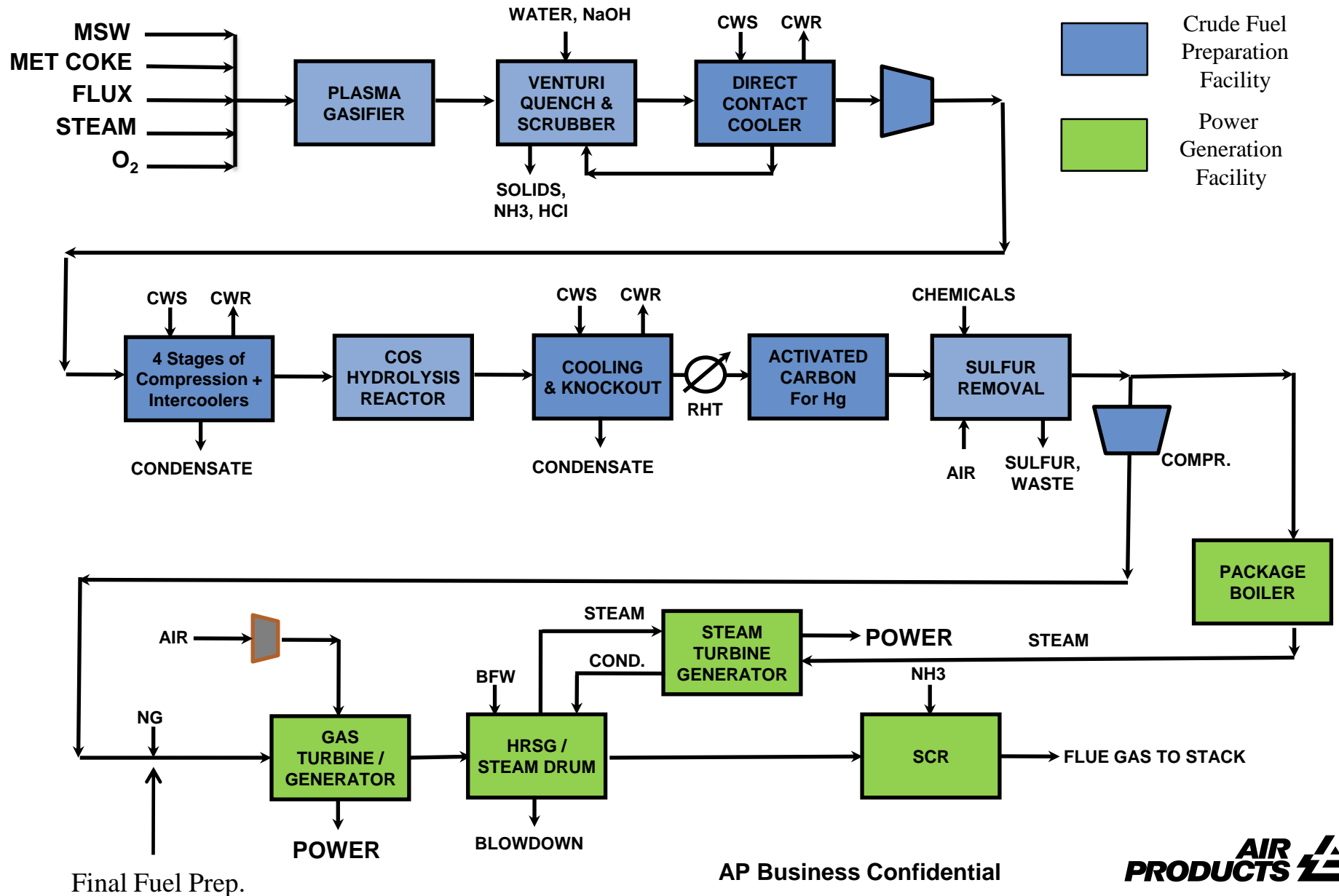
MSW	550-950 tpd
Biomass	525-1000 tpd
Coal (sub-bituminous)	500-900 tpd
Pet Coke	250-400 tpd

## Alter NRG Plasma Gasifier

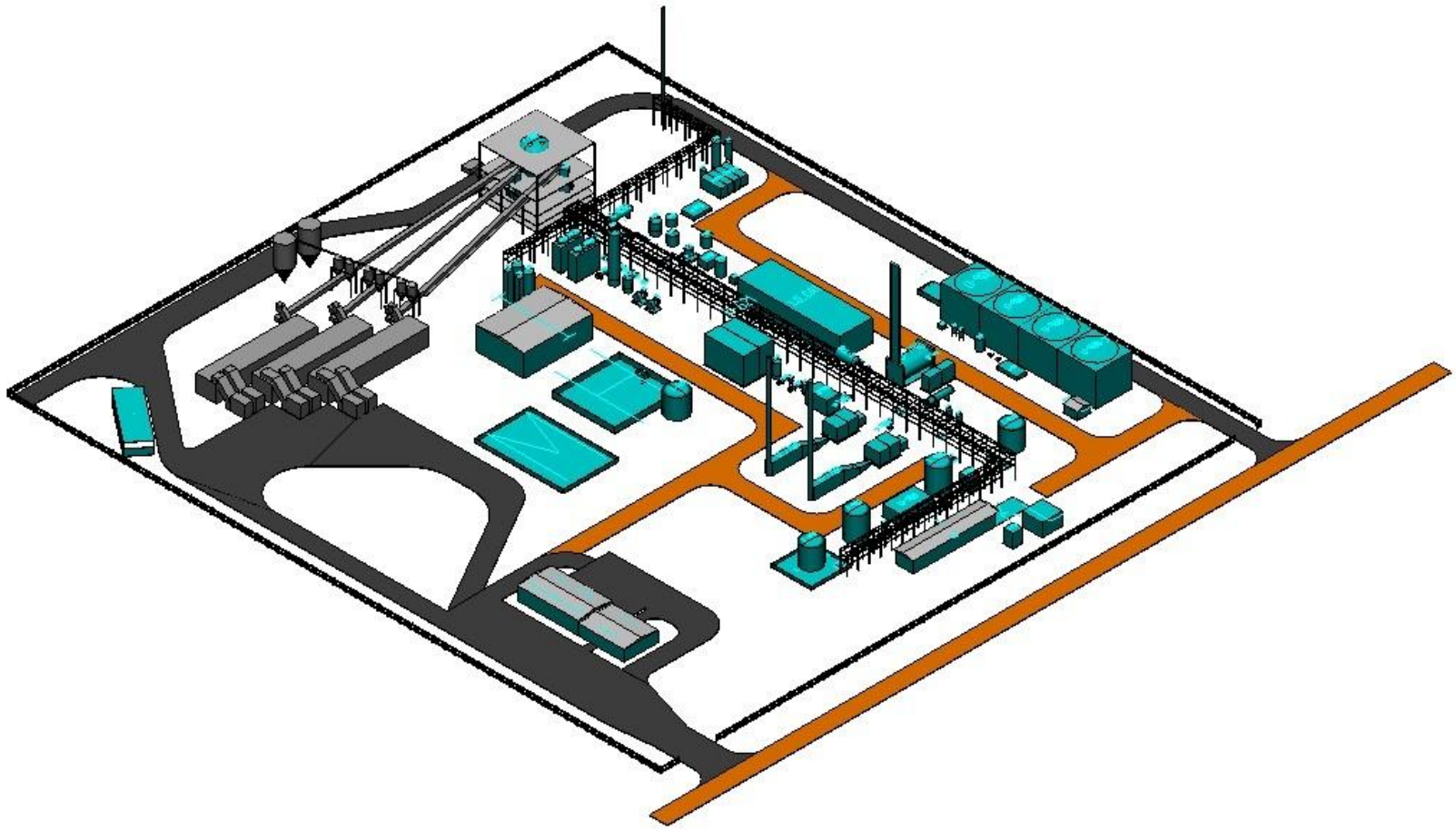


Harnessing the Power of Plasma

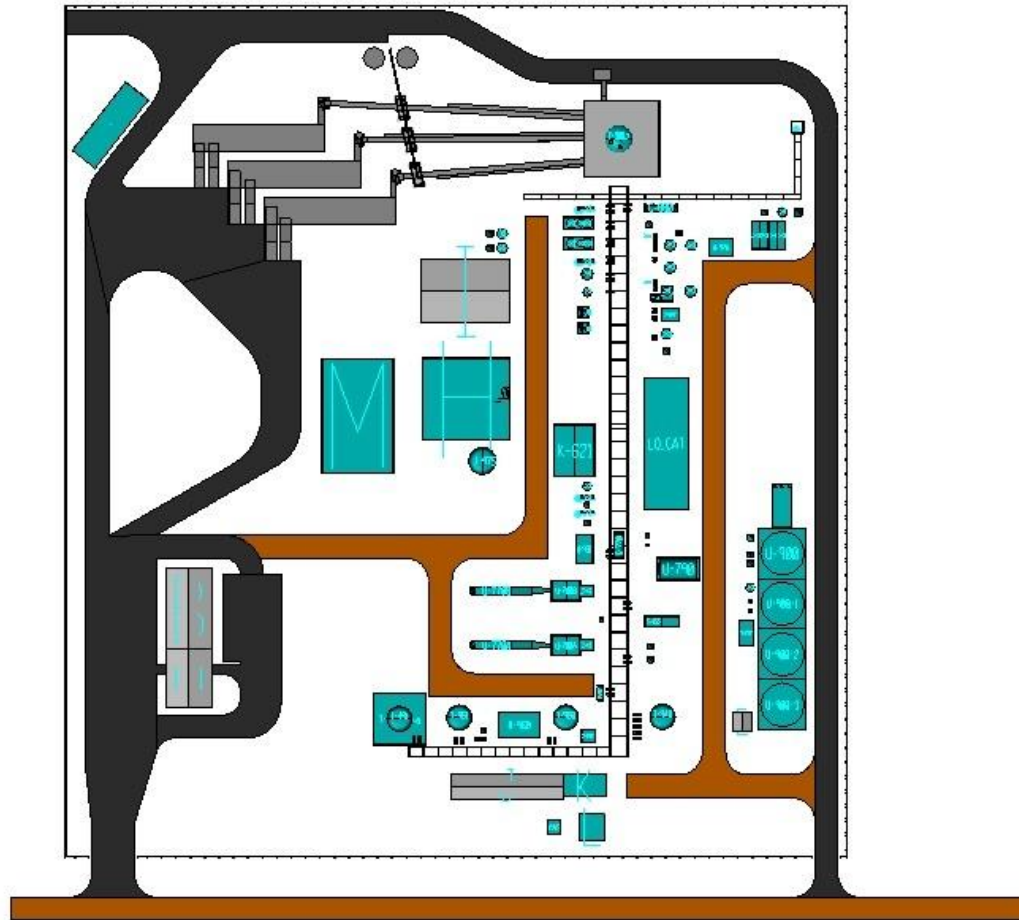
# PLASMA GASIFICATION OF MSW TEES VALLEY ENERGY FROM WASTE PROJECT



# Equipment Arrangement



# Plan





# Current Situation

## Planning and Consultation

- Our EPR application process is being followed in synergy with the Stockton Planning Consent process
- Environmental Impact Assessments and other key studies completed
  - Traffic Studies
  - Air Quality
  - Ecology
  - Noise
  - Archaeology



# Environmental Permit

- The EPR application process will be followed in synergy with the Stockton Planning Consent Process
- Expect to submit EPR permit application to Environment Agency Q12011
- Will operate to Best Available Techniques (BAT) as directed by the Environmental Agency

# Thank you



## tell me more

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**Telephone:** 020 3170 8465

**Email:** [Teesside@airproducts.com](mailto:Teesside@airproducts.com)

# Environmental Issues - Air

- MSW Storage/Odor Control
  - Minimized inventory vs Tipping floor
  - First In/First Out– MSW not allowed to putrefy
  - Enclosed unloading, transport, storage and handling for odor control; activated carbon capture of odors from vents
- GT/HRSO Stacks
  - SCR (NO<sub>x</sub> and CO)
  - GT's have standard combustors due to fuel properties. GT NO<sub>x</sub> is ~300 ppmv
  - NO<sub>x</sub> modeling for EIA - impacts not significant
- Flare
- Sulfur Removal System – Lo-Cat™
- Cooling Tower Drift

# Environmental Issues - Water

- Process is Net Producer of Water
  - Makeup Water System Backwashes and Regeneration Wastes
- Waste water segregated
  - Clean rain water
  - Treated non process water
    - Cooling Tower & Boiler Blowdowns
    - Containment area run off
  - Process and sanitary water for treatment
    - Quench/Scrubber
    - Compressor Intercooler Condensate

# Environmental Issues - Solids

- WWT Sludge recycled back to gasifier
- By products
  - Gasifier Slag- Inert, glassine, suitable for fill
  - Sulfur Filter Cake- 90-95% elemental sulfur; ~40% moisture
- Long-term Solid Waste Disposal
  - Activated Carbon – Mercury Beds
  - Water Treatment Resins
  - SCR Catalysts
  - COS hydrolysis catalyst

# Key Conclusions

- Helping to deliver the energy and waste management objectives of the North East & the UK
  - energy diversity & security
  - renewable power
  - reducing carbon footprint
  - waste diversion from landfills
- Latest technology (BAT) to be used to maximize efficiency and minimize environmental footprint
- Bringing jobs to the region
- Potential future source of renewable H<sub>2</sub>

# Summary

- Generation of reliable, cost effective renewable electricity from waste otherwise destined for landfill
- Strategic fit with local/regional/national policy (e.g. Tees Valley Unlimited Strategy)
- Long term investment commitment from Air Products